Citation:

Magarey AM, Daniels LA, Boulton TJC, Cockington RA. Does fat intake predict adiposity in healthy children and adolescents aged 2-15 y? A longitudinal analysis. *Eur J Clin Nutr* 2001; 55: 471-481.

PubMed ID: 11423924

Study Design:

Cohort Study

Class:

B - Click here for explanation of classification scheme.

Research Design and Implementation Rating:

POSITIVE: See Research Design and Implementation Criteria Checklist below.

Research Purpose:

To investigate the relationship between energy and macronutrient intake and body fatness assessed up to seven times between two and 15 years of age.

Inclusion Criteria:

Healthy term infants born at Queen Victoria Hospital, Adelaide, South Australia between November 1975 and June 1976.

Exclusion Criteria:

Not specified.

Description of Study Protocol:

- Subjects in Adelaide Nutrition Study (ANS) were first selected by birth order from healthy term infants born at Queen Victoria Hospital, Adelaide, South Australia between November 1975 and June 1976
- Anthropometric measurements of height, body mass index (BMI) and triceps (TC) and subscapular (SS) skinfold thicknesses were taken at at each age two, annually from age four to eight and at 11, 13 and 15 years of age
- BMI, TC and SS skinfold measurements were converted to standard deviation scores to allow for combination of data from boys and girls
- Dietary intake methodology and nutrient intake have been described by Boulton, 1981 and Magarey and Boulton, 1987, 1994. Intake was estimated from a three-day weighed food record at ages two, four and six years and a four-day weighed food record at eight, 11, 13 and 15 years of age. Energy/nutrient intakes were expressed as kJ per g per day.

- Parental anthropometric data were investigator-measured on one occasion only when children were eight to nine years of age.

Data Collection Summary:

Dependent Variables

- BMI
- Triceps (TC) and subscapular (SS) skinfolds, expressed as standard deviation scores.

Independent Variables

- Energy-adjusted macronutrient intake to include:
  - Fat (g and %)
  - Protein (g and %)
  - Carbohydrate (g and %)
  - Total energy intake.

Control Variables

- Previous corresponding measure of body fatness
- Gender and parental BMI
- Total energy intake
- The extent of under-reporting was assessed using the criteria of Goldberg et al, 1991.

Statistical Analysis

- All variables were tested for normality
- Differences between groups were examined using independent samples T-test
- A significance level of P=0.01 was used due to the large number of comparisons
- Energy-adjusted macronutrient intakes were computed as the residuals from the regression model in which energy intake was the independent variable and absolute nutrient intake was the dependent variable, using the model of Willett (1998)
- Generalized linear estimating equations were used to evaluate the longitudinal relationship between body fatness and macronutrient intake
- Multiple regression analysis was used to assess whether body fatness at a particular age was predicted by intake at any of the previous ages.

Description of Actual Data Sample:

- *Original sample:* 500 subjects from the ANS
- *Withdrawals/Drop-outs:* Details of the demographic status of participants and the reasons for cohort attrition have been published previously
- *Final sample:*
  - A core sample of ~150 were retained in a longitudinal study of growth and nutrition from birth to 15 years of age
  - A further 113 children from the same birth cohort were recruited to the ANS for the 11-year assessment
  - This gave a total of 243 subjects for assessment at 11 years and beyond.
- *Location:* Adelaide, South Australia

- *Race/Ethnicity:* Not specified
- *SES:* Not specified.

Summary of Results:

Longitudinal data

- There were no significant associations between either BMI s.d. score or TC skinfold s.d. score and any macronutrient
- There was a significant positive association between fat intake and SS s.d. score and a significant negative association between carbohydrate intake and this measure of fatness
- Aross two to 15 years, energy-adjusted fat and carbohydrate intakes were respectively directly and inversely related to SS skinfold measures but not to either BMI or TC skinfold
- For most ages, energy-adjusted macronutrient intakes at a previous age were not significant predictors of BMI s.d. score at subsequent ages
- In all analyses, previous BMI s.d. score had the greatest effect on subsequent BMI s.d. score and two to five times the effect of either maternal or parental BMI, the only other variables which were consistently significantly associated with BMI s.d. score
- Energy adjusted fat and carbohydrate intakes at two years were positively and negatively associated respectively, with SS s.d. score at 15 years.

Author Conclusion:

- These findings have implications for the prevention of overweight and obesity, particularly central obesity, which is associated with a higher risk of obesity-related complications such as heart disease and non-insulin dependent diabetes
- The current level of body fatness of the child and parental adiposity are more important predictors than dietary intake variables of risk of children becoming or remaining overweight as they grow.

Reviewer Comments:

Strengths

- *The use of the same observer for all children at every time point except two years is a strength of this study and minimizes the inter-observer error*
- *Long study duration.*

Limitations

- *Lack of control for energy expenditure*
- *Potential for under-recording of intake must be considered, especially with the high prevalence of overweight in this sample, however the use of energy adjusted macronutrient intakes should reduce the impact of systemic uner-reporting*
- *Precision and specificity associated with indirect estimates of body fatness and accuraately estimating dietary intakes needs to be considered.*

Research Design and Implementation Criteria Checklist: Primary Research

Relevance Questions		
1.	Would implementing the studied intervention or procedure (if found successful) result in improved outcomes for the patients/clients/population group? (Not Applicable for some epidemiological studies)	N/A
2.	Did the authors study an outcome (dependent variable) or topic that the patients/clients/population group would care about?	Yes
3.	Is the focus of the intervention or procedure (independent variable) or topic of study a common issue of concern to nutrition or dietetics practice?	Yes
4.	Is the intervention or procedure feasible? (NA for some epidemiological studies)	N/A

Validity Questions		
1.	**Was the research question clearly stated?**	Yes
1.1.	Was (were) the specific intervention(s) or procedure(s) [independent variable(s)] identified?	Yes
1.2.	Was (were) the outcome(s) [dependent variable(s)] clearly indicated?	Yes
1.3.	Were the target population and setting specified?	Yes
2.	**Was the selection of study subjects/patients free from bias?**	Yes
2.1.	Were inclusion/exclusion criteria specified (e.g., risk, point in disease progression, diagnostic or prognosis criteria), and with sufficient detail and without omitting criteria critical to the study?	Yes
2.2.	Were criteria applied equally to all study groups?	Yes
2.3.	Were health, demographics, and other characteristics of subjects described?	Yes
2.4.	Were the subjects/patients a representative sample of the relevant population?	Yes
3.	**Were study groups comparable?**	N/A
3.1.	Was the method of assigning subjects/patients to groups described and unbiased? (Method of randomization identified if RCT)	N/A
3.2.	Were distribution of disease status, prognostic factors, and other factors (e.g., demographics) similar across study groups at baseline?	N/A
3.3.	Were concurrent controls used? (Concurrent preferred over historical controls.)	N/A

3.4.	If cohort study or cross-sectional study, were groups comparable on important confounding factors and/or were preexisting differences accounted for by using appropriate adjustments in statistical analysis?	N/A
3.5.	If case control or cross-sectional study, were potential confounding factors comparable for cases and controls? (If case series or trial with subjects serving as own control, this criterion is not applicable. Criterion may not be applicable in some cross-sectional studies.)	N/A
3.6.	If diagnostic test, was there an independent blind comparison with an appropriate reference standard (e.g., "gold standard")?	N/A
4.	**Was method of handling withdrawals described?**	Yes
4.1.	Were follow-up methods described and the same for all groups?	Yes
4.2.	Was the number, characteristics of withdrawals (i.e., dropouts, lost to follow up, attrition rate) and/or response rate (cross-sectional studies) described for each group? (Follow up goal for a strong study is 80%.)	Yes
4.3.	Were all enrolled subjects/patients (in the original sample) accounted for?	Yes
4.4.	Were reasons for withdrawals similar across groups?	N/A
4.5.	If diagnostic test, was decision to perform reference test not dependent on results of test under study?	N/A
5.	**Was blinding used to prevent introduction of bias?**	Yes
5.1.	In intervention study, were subjects, clinicians/practitioners, and investigators blinded to treatment group, as appropriate?	N/A
5.2.	Were data collectors blinded for outcomes assessment? (If outcome is measured using an objective test, such as a lab value, this criterion is assumed to be met.)	Yes
5.3.	In cohort study or cross-sectional study, were measurements of outcomes and risk factors blinded?	N/A
5.4.	In case control study, was case definition explicit and case ascertainment not influenced by exposure status?	N/A
5.5.	In diagnostic study, were test results blinded to patient history and other test results?	N/A
6.	**Were intervention/therapeutic regimens/exposure factor or procedure and any comparison(s) described in detail? Were interveningfactors described?**	Yes
6.1.	In RCT or other intervention trial, were protocols described for all regimens studied?	N/A
6.2.	In observational study, were interventions, study settings, and clinicians/provider described?	Yes

6.3.	Was the intensity and duration of the intervention or exposure factor sufficient to produce a meaningful effect?	Yes
6.4.	Was the amount of exposure and, if relevant, subject/patient compliance measured?	Yes
6.5.	Were co-interventions (e.g., ancillary treatments, other therapies) described?	N/A
6.6.	Were extra or unplanned treatments described?	N/A
6.7.	Was the information for 6.4, 6.5, and 6.6 assessed the same way for all groups?	Yes
6.8.	In diagnostic study, were details of test administration and replication sufficient?	N/A
7.	**Were outcomes clearly defined and the measurements valid and reliable?**	Yes
7.1.	Were primary and secondary endpoints described and relevant to the question?	Yes
7.2.	Were nutrition measures appropriate to question and outcomes of concern?	Yes
7.3.	Was the period of follow-up long enough for important outcome(s) to occur?	Yes
7.4.	Were the observations and measurements based on standard, valid, and reliable data collection instruments/tests/procedures?	Yes
7.5.	Was the measurement of effect at an appropriate level of precision?	Yes
7.6.	Were other factors accounted for (measured) that could affect outcomes?	Yes
7.7.	Were the measurements conducted consistently across groups?	Yes
8.	**Was the statistical analysis appropriate for the study design and type of outcome indicators?**	Yes
8.1.	Were statistical analyses adequately described and the results reported appropriately?	Yes
8.2.	Were correct statistical tests used and assumptions of test not violated?	Yes
8.3.	Were statistics reported with levels of significance and/or confidence intervals?	Yes
8.4.	Was "intent to treat" analysis of outcomes done (and as appropriate, was there an analysis of outcomes for those maximally exposed or a dose-response analysis)?	N/A
8.5.	Were adequate adjustments made for effects of confounding factors that might have affected the outcomes (e.g., multivariate analyses)?	Yes
8.6.	Was clinical significance as well as statistical significance reported?	Yes

8.7.	If negative findings, was a power calculation reported to address type 2 error?	N/A
9.	**Are conclusions supported by results with biases and limitations taken into consideration?**	Yes
9.1.	Is there a discussion of findings?	Yes
9.2.	Are biases and study limitations identified and discussed?	Yes
10.	**Is bias due to study's funding or sponsorship unlikely?**	Yes
10.1.	Were sources of funding and investigators' affiliations described?	Yes
10.2.	Was the study free from apparent conflict of interest?	Yes